

**Laser Processed Heat Exchangers**  
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**Abstract**

The Laser Processed Heat Exchanger project will investigate the use of laser processed surfaces to reduce mass and volume in liquid/liquid heat exchangers as well as the replacement of the harmful and problematic coatings of the Condensing Heat Exchangers (CHX). For this project, two scale unit test articles will be designed, manufactured, and tested. These two units are a high efficiency liquid/liquid HX and a high reliability CHX.

**Full Description**

The considerable mass of Heat Exchangers (HXs) and coldplates on spacecraft as well as the problematic coatings of the Condensing Heat Exchanger (CHX) are among the significant technical issues to be solved before long-duration spaceflight can occur. Specifically, high reliability CHX's and reduced mass HXs and coldplates have been identified by the Evolvable Mars Campaign (EMC) as critical technologies needed to move beyond low earth orbit. The Laser Processed Heat Exchanger project aims to solve these problems. It will investigate the use of femtosecond laser processed surfaces to replace the harmful and problematic coatings of current CHX's and to reduce mass and volume in liquid/liquid heat exchangers. For this project, two sub-scale HX's will be designed, manufactured, and tested. These two units consists of a high reliability CHX and a high efficiency liquid/liquid HX. The goal of the high reliability CHX is to eliminate the dependency upon coatings and prove the feasibility in manufacturing a hydrophobic laser patterned CHX. Additionally, microbial growth testing will be conducted on the unit to assess its potential as a microbial growth mitigation strategy. The goal of the liquid/liquid HX is to increase heat transfer by 25% compared to an identical non-treated HX, directly translating to reduced mass and volume.